III. *Magnetical Experiments and Obſervations.* *By Mr.* Tiberius Cavallo, *F. R. S.*

(The Lecture founded by the late HENRY BAKER, Eſq. F.R.S.)

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THE object of this lecture is to ſhew the properties of ſome metallic ſubſtances with reſpect to magnetiſm; and the experiments herein related ſeem to aſcertain ſome new and remarkable facts.

The magnetic properties have been generally thought to belong only to iron, or to thoſe ſubſtances which contained that metal; comprehending under the general name of iron not only the metal commonly ſo called, but likewiſe its more perfect and more imperfect ſtates, *viz.* ſteel, iron ores, amongſt which is conſidered the magnet, and the calces of iron, excepting only thoſe which are very much dephlogiſticated, for they poſſeſs no magnetic property whatſoever. Some other metallic ſubſtances, and eſpecially platina, braſs, and nickel, on which the magnet has ſome action, were thought to be magnetic ſo far as they contained ſome portion of iron, the preſence of which may be manifeſted by chemical methods in many caſes, but not always; becauſe the quantity of iron may be ſo exceſſively ſmall in proportion to the weight of the other metal in which it is concealed, as not to be diſcoverable by chemical analyſis, and yet it may be ſufficient to affect the magnetic needle.

needle. The following experiment will ſhew, that an exceedingly ſmall quantity of iron will render a body ſenſibly magnetic.

Having choſen a piece of Turkey-ſtone, which weighed about an ounce, I examined it by a very ſenſible magnetic needle, and found that it had not the leaſt degree of magnetiſm, the needle not being moved from its uſual direction by the vicinity of any part of the ſurface of the ſtone; I then weighed a piece of ſteel with a pair of ſcales that turned with the twentieth part of a grain, and afterwards drew one end of it over the ſurface of the ſtone in various directions. This done, the piece of ſteel was weighed again, and was found to have loſt ſo ſmall a part of its weight as not to be diſcernible by that pair of ſcales; yet the Turkey-ſtone, which had acquired only that ſmall quantity of ſteel, affected the magnetic needle very ſenſibly. Chemiſtry ſeems not to afford any means by which ſo ſmall a quantity of iron may be deciſively detected in a body that weighs one ounce. Hence it follows, that though no iron is to be diſcovered in a body by chemical methods, yet it ſhould not be concluded, that the ſaid body, if it affect the magnetic needle, does not own its magnetiſm to ſome ſmall quantity of iron concealed in its ſubſtance.

Nickel is a metallic ſubſtance which has been ſuſpected to be capable of acquiring ſome degree of magnetiſm independent of iron; and this ſuſpicion has been founded upon obſerving, that nickel retained its magnetiſm after having been repeatedly purified*. There are, however, perſons who have denied the magnetiſm of purified nickel; and I have ſeen ſome pieces of it which did not in the leaſt affect the magnetic needle. It is probable, that thoſe pieces were not pure nickel, and perhaps

* See KIRWAN's Mineralogy, p. 342. and 367.

ſome

ſome cobalt was contained in them; but I ſee no reaſon why the nickel, when alloyed with a little cobalt, ſhould ſhew no magnetiſm, if that property does really belong eſſentially to it.

The greateſt number of my experiments are relative to the properties of braſs; and they ſeem to prove, that this compound metal, which is often magnetic, does not owe its magnetiſm to iron, but to ſome particular configuration of its component particles, occaſioned by the uſual method of hardening it, which is by hammering.

In ſome ſpecimens of braſs, and eſpecially in that which has often paſſed from the work-ſhop to the furnace, and from the latter to the former, there are ſometimes pieces of iron ſenſible not only to the magnet, or the chemical analyſis, but even to the ſight, which render the braſs ſtrongly magnetic. But the braſs generally uſed in my experiments was ſuch as, when quite ſoft, it had no ſenſible degree of magnetiſm.

Before we begin with the narration of thoſe experiments, it will be proper to deſcribe the magnetic needle I generally uſed, which is ſuſpended in a particular manner; and which may be uſeful to perſons who are fond of making magnetic experiments, not only for its ſenſibility, but likewiſe for the ſimplicity of its conſtruction.

Experience having ſhewn, that large magnetic needles are not proper for experiments wherein a very ſmall degree of magnetiſm muſt be aſcertained, and the free motion of the uſual ſmall needles being proportionally more obſtructed by the nature of their ſuſpenſion, even when furniſhed with agate caps, I endeavoured to contrive a ſort of ſuſpenſion which might anſwer the purpoſe better than the needles ſuſpended in the uſual manner; and, after ſeveral attempts, at laſt I conſtructed a chain

of

of horſe-hair, conſiſting of five or ſix links, to which the needle was ſuſpended. Each link is about three-quarters of an inch in diameter; and the extremities of each piece of hair, which is formed in a ring, are joined by a knot, and ſecured by a little ſealing-wax. The link on one end of this chain is ſuſpended to a pin in a proper frame, or any ſupport that may be at hand; and to the link of the other extremity which lies lowermoſt, a piece of fine ſilver wire is hooked. This wire is about an inch and a half long, and its lower extremity is faſtened round a ſmall and cylindrical piece of cork, through which a common ſewing needle, made magnetic, is thruſt horizontally. Thus the magnetic needle is ſuſpended by a hair-chain, the links of which, on account of the ſmoothneſs and lightneſs of the hair, move very freely in each other, and allow the needle more than a whole revolution round its centre, with ſo ſmall a degree of friction as may be conſidered next to nothing. By comparing this needle with others of the beſt ſort in uſe, I find the former to be much more ſenſible; for when bodies which have an exceedingly ſmall magnetic power are tried, this needle will be frequently attracted by them when the others are not ſenſibly affected.

In order to try farther the delicacy of ſuch ſuſpenſion, I placed a piece of looking-glaſs under the needle, and nearly horizontal, ſo that the image of the needle was ſeen in it. Now, as a fine line had been previouſly marked on the glaſs, things were ſo diſpoſed as that the image of the needle might coincide with the line marked on the glaſs, the eye being placed in a proper point of view; afterwards, by ſhaking the needle either very gently or very quickly, I repeatedly endeavoured to place it out of the magnetic meridian; but every

endeavour proved ineffectual, for the needle conſtantly ſettled in the ſame direction, without any ſenſible variation.

With a needle thus ſuſpended a variation compaſs might be very eaſily conſtructed, and it would perhaps be more accurate than thoſe commonly in uſe. For this purpoſe the needle ought to be about three inches long, and the piece of looking-glaſs ought to be fixed upon the index of an HADLEY's ſextant, which muſt be placed horizontally under the needle, with its edge or fiducial line in the meridian of the place, in order to obſerve the daily variation of the needle. I have made only a rough model of ſuch a variation compaſs, and it ſeemed to anſwer very well. This conſtruction appears to have the following advantages over the common ſort: 1ſt, the needle being cylindrical, and without a hole in the middle, would be leſs ſubject to have more than two poles. 2dly, The needle being ſlender, its poles would ſtand more exactly in its axis, which with the common flat needles is ſeldom the caſe. 3dly, It will appear, by a little conſideration, that in this conſtruction there is no need of the needle's center of motion keeping always in the ſame invariable point, which renders the conſtruction both very eaſy and very accurate: and, laſtly, as the ſextant may be placed at a conſiderable diſtance below the needle, and the reſt of the frame may be made of any ſize, there would be no neceſſity of placing any braſs or other metal ſo near the needle as might affect it in caſe this metal had any magnetiſm, which generally happens with braſs.

In order to examine the magnetiſm of divers ſubſtances, beſides the above deſcribed needle, I uſed to put a ſmall magnetic needle upon water, and then bring the ſubſtance to be examined near it, or place the ſubſtance itſelf upon water, ſometimes

ſometimes reſting it upon pieces of cork, and then bring a powerful magnet near it.

Examination of the Magnetical Properties of Braſs.

A few years ago, being intent on making ſome magnetic experiments, in which braſs was concerned, I uſed to examine firſt whether the pieces of braſs had any magnetiſm or not, and rejected thoſe pieces which had an evident degree of that power. In the courſe of thoſe experiments I remember to have obſerved, that thoſe pieces of braſs which had been hammered were generally magnetic, and much more ſo than others; in conſequence of which I made no uſe of hammered braſs in thoſe experiments. But lately, having ordered a theodolite at a philoſophical inſtrument ſhop, I particularly enjoined the workmen to try the braſs, both ſoft and hammered, before they worked it, and to make no uſe of that which had any magnetiſm. They found, that hammered braſs, even ſuch as before the hammering had no magnetiſm, could afterwards diſturb the magnetic needle very ſenſibly. Theſe obſervations induced me to make the following experiments.

EXPERIMENT I.

An oblong piece of braſs, weighing ſomewhat leſs than half an ounce, being examined by preſenting every part of its ſurface to the ſuſpended needle, ſhewed no ſign of magnetiſm whatever. It was then hammered for about two minutes; the conſequence of which was, that it became magnetic ſo far as to attract either end of the needle from about a quarter of an inch. This ſame piece of braſs being now put into the fire ſo as

to become red-hot, by which means it was ſoftened, and when cold being preſented to the ſuſpended needle, its magnetiſm was found to be entirely gone. Hammering made it again magnetic. Softening by fire took the magnetiſm away a ſecond time; and thus the magnetiſm was repeatedly given it by hammering, and was deſtroyed by ſoftening; ſometimes ſhewing to have acquired a ſenſible degree of that power, even after two or three ſtrokes of the hammer.

EXPERIMENT II.

The reſult of the firſt experiment would naturally induce one to ſuſpect, that the hammer and anvil might have imparted ſome ſmall quantity of ſteel to the braſs, which rendered it magnetic; and that this magnetiſm was deſtroyed in ſoftening the braſs, inſomuch as the fire calcined the ſmall quantity of ſteel that had adhered to it. In conſequence of which conſideration, I took other pieces of braſs beſides that uſed before, and hammered them between card-paper, changing the pieces of paper as often as was neceſſary, ſince they were eaſily broken by the hammer; but the pieces of braſs became conſtantly magnetic by the hammering, and their magnetiſm was deſtroyed by fire.

In this experiment I generally gave to the braſs not above thirty ſtrokes with the hammer.

EXPERIMENT III.

Still ſuſpecting that the hammer and the anvil might have imparted ſome ſmall quantity of iron to the braſs, becauſe the pieces of card-paper ſometimes were broken by the firſt or ſecond

ſecond ſtroke, in which caſe either the hammer or the anvil touched the braſs; I hardened a piece of braſs by beating it between two large flints, *viz.* uſing one for the hammer, and the other for the anvil. The piece of braſs became magnetic, though in this caſe it ſeemed to have acquired not ſo much power as when it had been hardened with the hammer; but it muſt be obſerved, that the flints being rough and irregular, the piece of braſs could not be hardened by them ſo eaſily, or ſo equally, as by the other method.

The flints, being examined both before and after the experiment, were found to have not the leaſt degree of magnetiſm.

EXPERIMENT IV.

A piece of braſs, which by hammering had been rendered ſo ſtrongly magnetic as to attract either pole of the needle from about a quarter of an inch, was put into a crucible, together with a conſiderable quantity of charcoal duſt, which ſurrounded it every where. The crucible was covered with clay, and being put into the fire, was kept red-hot for about ten minutes. After cooling, the piece of braſs was taken out of the crucible, and being examined, was found to have entirely loſt its magnetiſm. The object of this experiment was to aſcertain whether the loſs of magnetiſm, in a piece of braſs that was ſoftened, was owing to the calcination of the ferrugineous particles, which, notwithſtanding the preceding experiments, might ſtill be ſuſpected to be imparted to it; becauſe in this way of ſoftening the braſs, the ferrugineous particles being ſurrounded with charcoal duſt, could not have been calcined; hence the braſs ought not to have loſt its magnetiſm, which was not the reſult of the experiment.

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EXPERIMENT V.

One of thoſe pieces of braſs which had been uſed for the foregoing experiments, and which had been deprived of magnetiſm by fire, was hammered between two large and pretty thick pieces of copper, which were not in the leaſt magnetic; and, after a few ſtrokes of the hammer, it became ſenſibly magnetic.

EXPERIMENT VI.

In order to examine the difference of this property in braſs of various kinds, I have tried a great many pieces of Engliſh as well as foreign braſs; ſome of which was very old, and ſo fine and uniform, that an eminent watch-maker of my acquaintance uſed it for the very beſt ſort of watch work. But I find, that they moſtly have the property of becoming magnetic by hammering, and of loſing that power when ſoftened. There are, however, ſome pieces which acquire no magnetiſm by the hammering, though they are rendered equally hard by it as thoſe which acquire the magnetiſm. By attentively examining them, I have not yet been able to diſtinguiſh, without a trial, which pieces are capable of acquiring magnetiſm, and which not; the colour, apparent texture, and degree of ductility ſeeming to afford no ſure indication. In ſhort, what I have obſerved relating to the magnetic properties of braſs is:

1ſt, That moſt braſs becomes magnetic by hammering, and loſes the magnetiſm by annealing or ſoftening in the fire.

2dly, That the acquired magnetiſm is not owing to particles of iron or ſteel imparted to the braſs by the tools employed.

3dly,

3dly, Thoſe pieces of braſs which have that property, retain it without any diminution after a great number of repeated trials, *viz.* after having been repeatedly hardened and ſoftened. But I have not found any means to give that property to ſuch braſs as had it not naturally.

4thly, A large piece of braſs has generally a magnetic power ſomewhat ſtronger than a ſmaller piece; and the flat ſurface of the piece draws the neeedle more forcibly than the edge or corner of it.

5thly, If only one end of a large piece of braſs be hammered, then that end alone will diſturb the magnetic needle, and not the reſt.

6thly, The magnetic power which braſs acquires by hammering has a certain limit, beyond which it cannot be increaſed by farther hammering. This limit is various in pieces of braſs of different thickneſs, and likewiſe of different quality.

7thly, Though there are ſome pieces of braſs which have not the property of being rendered magnetic by hammering; yet all the pieces of magnetic braſs, that I have tried, loſe their magnetiſm by being made red-hot, excepting indeed when ſome piece of iron is concealed in them, which ſometimes occurs; but in this caſe, the piece of braſs, after having been made red-hot and cooled, will attract the needle more forcibly with one part of its ſurface than with the reſt of it; and hence, by turning the piece of braſs about, and preſenting every part of it ſucceſſively to the ſuſpended magnetic needle, one may eaſily diſcover in what part of it the iron is lodged.

From thoſe obſervations it follows, that when braſs is to be uſed for the conſtruction of inſtruments wherein a magnetic needle is concerned, as dipping needles, variation compaſſes, &c. the braſs ſhould be either left quite ſoft, or it ſhould be

choſen of ſuch a ſort as will not be made magnetic by hammering, which ſort however does not occur very eaſily.

Examination of the Magnetic Properties of ſome other Metallic Subſtances.

The reſult of the experiments on braſs induced me to examine other metallic ſubſtances, and eſpecially its components, *viz.* copper and zinc: though the reſult of the experiments has not been very remarkable, excepting with platina, which metal has properties in great meaſure analogous to thoſe of braſs.

Having examined various pieces of copper, by means of the ſuſpended magnetic needle, and having never found them magnetical, except only ſometimes in ſuch places which had been filed, and where ſome particles of ſteel might have been left by the file, I next proceeded to hammer ſome pieces of it, not only in the uſual way, but likewiſe between flints: the reſult, however, was very dubious; for though, in general, they had no effect whatever on the needle, yet ſometimes I thought the needle was really attracted by ſome pieces of hammered copper; but then this attractive power was ſo exceedingly ſmall as not to be depended upon.

Zinc, either not hammered, or hammered as far as could be done without breaking it, ſhewed no ſigns of magnetiſm whatever, when preſented to the magnetic needle. A mixture of zinc and tin neither had any action upon the needle.

A piece of a broken reflector of a teleſcope, which conſiſted of tin and copper; a mixture of tin, zinc, and a little copper; a piece of ſilver, both ſoft and hammered; a piece of pure gold, both ſoft and hammered; a mixture of gold and ſilver, both hard and ſoft; and another mixture of a great deal of

ſilver, a little copper, and a leſs quantity of gold, either before or after hammering, had not the leaſt action on the magnetic needle.

Platina was the metal I laſt examined, and the experiments made with it ſeem to deſerve particular attention.

EXPERIMENT I.

A large piece of platina, which, after being precipitated from its ſolution in *aqua regia*, had been fuſed, or rather concreted together, being preſented to the ſuſpended magnetic needle, ſhewed not the leaſt ſign of magnetiſm. It was then hammered; but after the third or fourth ſtroke of the hammer it broke into many pieces, ſeveral of which being tried, ſhewed no magnetiſm, nor could any of the fineſt particles be attracted by the magnet preſented very nearly over them. The broken ſurface of this piece of platina was full of cavities, ſome of which were large, and others juſt diſcernible; and altogether the metal ſeemed to have undergone an imperfect fuſion.

EXPERIMENT II.

The grains of native platina were examined next, by putting a magnet juſt over them; but the magnet attracted not above ten or twenty particles out of about half an ounce of platina: and thoſe which were attracted had either little or no ſhining metallic appearance like the reſt, and were exceedingly ſmall.

EXPERIMENT III.

Having picked out ſeveral of the largeſt grains of platina, I preſented the magnet to them; but they were not

in the leaſt attracted by it. One of thoſe grains was then hammered; by which means, after about eight or ten ſtrokes, it was ſpread into a plate, about a tenth of an inch in diameter, and nearly circular; afterwards the magnet being preſented to it, the former attracted it from the diſtance of about one-twentieth of an inch. The other grains being all hammered one after the other, were rendered by it ſo far magnetic as to be attracted by the magnet, and to diſturb the ſuſpended needle when they were preſented to it. But there were ſome amongſt them which acquired no magnetiſm at all, though they had been purpoſely hammered much longer than the others.

As far as I could obſerve, thoſe pieces which would not acquire any magnetiſm by hammering, had not a very ſhining appearance before the hammering, though afterwards they could not be diſtinguiſhed from the others by their appearance; and they ſeemed not to ſpread under the hammer ſo eaſily as the others.

In general three or four ſtrokes are ſufficient to render a grain of platina evidently magnetic, but about ten ſtrokes give it the full power it is ſuſceptible of.

EXPERIMENT IV.

Thoſe grains of platina, which in the preceding experiments had been rendered magnetic by hammering, being put upon a charcoal, were made red-hot by means of a blow-pipe; and afterwards being preſented to the magnet, and likewiſe to the ſuſpended needle, they ſhewed not the leaſt ſign of magnetiſm. Heat, therefore, deprives them as well as braſs of the magnetiſm acquired by hammering. A ſecond hammering rendered them magnetic, though not ſo quickly, nor to ſo great a

degree, as it had done the firſt time. However, it muſt be obſerved, that the pieces of platina having been rendered flat and thin by the firſt hammering, could not be ſo eaſily ſtruck, nor ſpread much more, by the ſecond.

If it is true, as thoſe experiments ſeem to prove beyond a doubt, that magnetiſm may exiſt, or may belong to other ſubſtances, independent of iron, it muſt follow, that the attraction of a few particles of an unknown ſubſtance by the magnet is not a ſure ſign of the preſence of iron. Hence thoſe ſubſtances, which hitherto have been conſidered as containing ferrugineous particles, for no other reaſon but becauſe the magnet attracted a ſmall quantity of them, muſt be conſidered as dubious; and the concluſion of the exiſtence of iron ſhould not be admitted, except when thoſe particles, which have been ſeparated by the magnet, appear to be iron by ſome other trial; for though it is true, that iron is always attracted by the magnet, yet it does not hence follow, that whatever is attracted by the magnet muſt be iron.

POSTSCRIPT.

THE exiſtence of magnetiſm, or of the power of attracting and being attracted by the magnetic needle, in bodies, without the interference of iron or any ferrugineous matter, being a propoſition not only new and ſingular, but ſeemingly of importance in philoſophy, the experiments which tend to confirm it ſhould be never deemed ſuperfluous, nor any poſſible objection be left unanſwered: hence, ſince the writing of the foregoing paper, I have endeavoured to raiſe objections, and to con-

trive means of explaining them; but every conſideration ſeemed to confirm the propoſition advanced. The principal of thoſe objections was, that the braſs which becomes magnetic by hammering and loſes that power by ſoftening, might contain a ſmall quantity of iron, to which that magnetic power was owing; and that this iron or martial earth, diſperſed through the ſubſtance of the braſs, might become phlogiſticated by the action of hammering; inſomuch as the braſs being forced into a ſmaller ſpace might perhaps give ſome of its phlogiſton to the martial earth, and thus render it magnetic; and, on the contrary, the action of the fire in ſoftening might remove that phlogiſton from the martial earth, and give it to the braſs; hence the former, remaining quite dephlogiſticated, would no longer ſhew any ſigns of magnetiſm. The conſideration that iron may be dephlogiſticated or calcined more eaſily than braſs gave an apparent weight to the ſuppoſition; but the following experiments ſeem to expel every doubt.

EXPERIMENT I.

Having choſen a piece of braſs which would acquire no magnetiſm by hammering, I placed it upon the anvil, together with a conſiderable quantity of *crocus martis*, which crocus had no action on the magnetic needle; then began hammering the braſs, and turning it frequently, in order to let part of the crocus adhere to it; and, in fact, the crocus had in ſeveral places been faſtened ſo well into the braſs, that hard wiping with a woollen cloth would not rub it off. The braſs appeared red in thoſe places; but, after having been hammered for a long time, it acquired no magnetiſm whatever. The hardening, there-

fore, could not render the iron calx ſo far phlogiſticated as to affect the magnetic needle.

EXPERIMENT II.

In order to diverſify the preceding experiment, I drilled a hole, about one-eighth of an inch long, and little more than one-fiftieth of an inch in diameter, into a piece of braſs that was not rendered magnetic by hammering, and filled it with *crocus martis*; then I hammered the piece of braſs, thus incloſing the calx of iron, and afterwards preſented it to the needle; but there was not the leaſt ſign of attraction: the martial earth, therefore, had not acquired any phlogiſton from the braſs by the action of hammering.

EXPERIMENT III.

The piece of braſs mentioned in the preceding experiment, *viz.* with a little calx of iron in it, was put into the fire, and was made quite red-hot, in which ſtate it remained for about three minutes. Then, after cooling, it was preſented to the magnetic needle, and this was attracted by the braſs only in that place wherein the calx of iron was contained. The action, therefore, of the fire had rendered the martial earth ſo far phlogiſticated as to attract the magnetic needle; hence, if the magnetiſm of braſs was owing to any ferrugineous matter contained in it, a piece of braſs ought to become magnetic when ſoftened, which is contrary to the experiments mentioned in this paper.

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EXPERIMENT IV.

A hole, ſimilar to that mentioned in the ſecond experiment, was drilled into a piece of braſs that would not become magnetic by hammering, and into it was put ſome black calx of iron, which was ſo far phlogiſticated as to be attractable by the magnet, and the hole was cloſed by a few ſtrokes of the hammer. In conſequence of which the piece of braſs, when preſented to the ſuſpended magnetic needle, would attract it only about that place where the magnetic calx was contained. This attraction was very weak. Then the piece of braſs, thus prepared, was put into the fire, and was kept for about ſix minutes, in a heat very little ſhort of that neceſſary to melt braſs, and after cooling I preſented it to the needle, expecting that the fire might have dephlogiſticated that calx of iron ſo far as not to let it act any longer upon the needle; but the attraction appeared to be of the ſame degree it was before the heating.

It ſeems, therefore, to be demonſtrated, as far as the ſubject will admit of demonſtration, that the magnetiſm acquired by braſs, when hammered, is not owing to iron contained in it; and, conſequently, that *magnetiſm, or the power of being attracted by, and attracting, the magnet, may exiſt independent of iron.*

TO

TO DR. BLAGDEN, SEC. R. S.

SIR, Windſor, January 9, 1786.

I HAVE made the experiment which you recommended me to try, relating to the magnetiſm of braſs; *viz.* I mixed, by means of the blow-pipe, a ſmall quantity of iron, with about four times its weight of ſuch braſs as would not become magnetic by hammering. The whole globule weighed about two grains, and it attracted the magnetic needle very powerfully. I then melted this globule of braſs and iron with about fifty grains of the ſame ſort of braſs as had been uſed before. After cooling, the whole lump of braſs appeared to have very little power upon the magnetic needle, every part of its ſurface attracting one end of the ſuſpended needle, ſo as to let it juſt adhere to it when the air was not at all diſturbed. But this weak and hardly perceivable degree of magnetiſm was not increaſed by hammering, nor annihilated by ſoftening.

In the courſe of my experiments on the magnetiſm of braſs, I have twice obſerved the following remarkable circumſtance. A piece of braſs, which had the property of becoming magnetic by hammering, and of loſing the magnetiſm by ſoftening, having been left in the fire till it was partially melted, I found, upon trial, that it had loſt the property of becoming magnetic by hammering; but having been afterwards fairly melted in a crucible, it thereby acquired the property it had originally, *viz.* that of becoming magnetic by hammering.

I have

I have likewiſe often obſerved, that a long continuance in a fire ſo ſtrong as to be little ſhort of melting hot, generally diminiſhes, and ſometimes quite deſtroys, the property of becoming magnetic in braſs. At the ſame time, the texture of the metal is conſiderably altered, becoming what ſome workmen call *rotten*. From this it appears, that the property of becoming magnetic in braſs by hammering, is rather owing to ſome particular configuration of its parts, than to the admixture of any iron; which is confirmed ſtill farther by obſerving, that Dutch plate-braſs (which is made not by melting the copper, but by keeping it in a ſtrong degree of heat whilſt ſurrounded by *lapis calaminaris)* alſo poſſeſſes that property; at leaſt all the pieces of it, which I have tried, have that property.

I am, &c.

T. CAVALLO.